

Section 3.4 - Predictions & Lines: $y = mx + b$

Curriculum Outcomes	Related Activities	Page in Text
<ul style="list-style-type: none"> determine the slope and y-intercept of a line from a table of values 	<ul style="list-style-type: none"> an investigation explores the connection between the values of m and b in an equation, the graph of the equation, and the original situation 	118
<ul style="list-style-type: none"> determine the equation of a line using the slope and y-intercept 	<ul style="list-style-type: none"> a Focus shows the connection between the graph, equation, and the m and b and demonstrates how slope can be found and why it is important 	117
<ul style="list-style-type: none"> rearrange equations 	<ul style="list-style-type: none"> students solve problems using the skills they have learned with writing equations in the form $y = mx + b$ 	122
	<ul style="list-style-type: none"> students investigate how to find equations of straight lines from limited information and use the equations to solve problems 	126
<ul style="list-style-type: none"> graph by constructing a table of values, by using graphing technology, and when appropriate by intercept-slope method 	<ul style="list-style-type: none"> students rearrange equations and formulas in order to graph the equation or enter formulas into a spreadsheet. 	128

- The equations we have been dealing with are linear equations or **equations of lines**.
- Equations of lines can be written in **$y = mx + b$ format** or **slope y-intercept form** which is also known as **standard form**.
- To be able to determine the equation of a line we need 2 things:
 - a **slope**
 - a **point on the line**

SLOPE:

- the steepness of a line
- in equation form it is the coefficient of the variable x.
- in the format $y = mx + b$ $m = \text{slope}$

$$y = 4x + 8$$
$$y = 2x + 4$$



Types of Slopes:

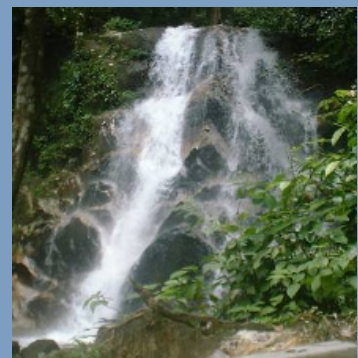
Slope

Positive

Negative





Undefined

Zero



Steepness of Slopes:

Examples of Slopes for Steepness

			
Not Steep	A Little Steeper	Even Steeper	Very Steep
Slope = 0.1	Slope = 1	Slope = 2	Slope = 4

Small slope

Large slope

How to Find Slope:

① From the equation $y = mx + b$

the number found
where the "m" is

Examples:

1. $y = -2x + 3$

$m = -2$
 $b = +3$



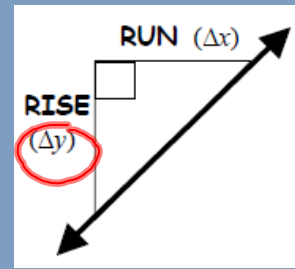
2. $y = \frac{1}{3}x - 2$

$m = \frac{1}{3}$
 $b = -2$

2

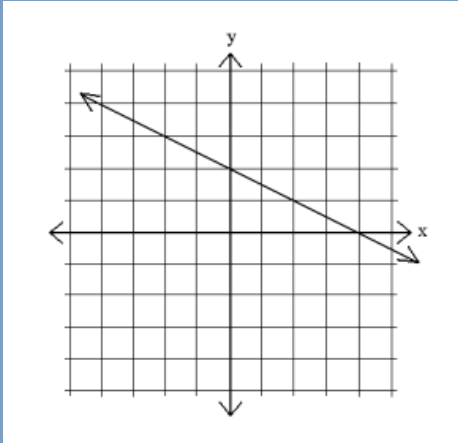
From a graph using rise
run

$$m = \frac{\Delta y}{\Delta x}$$

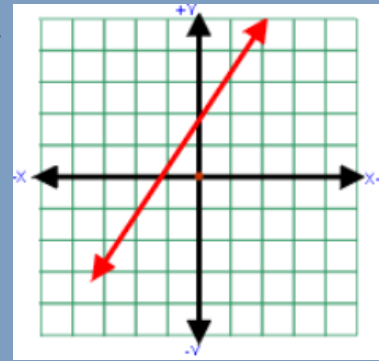


Examples:

1.



2.



3

From 2 co-ordinate points

$$m = \frac{y_2 - y_1}{x_2 - x_1} \quad \begin{matrix} \text{rise} \\ \text{run} \end{matrix}$$

Examples:

1. (2, 7) & (5, 1)
 x_1, y_1 x_2, y_2

$$m = \frac{1 - 7}{5 - 2} = \frac{-6}{3} = -2$$

$$m = -2$$

2. (-2, 5) & (-5, 5)
 x, y x, y

$$m = \frac{5 - 5}{-5 - (-2)} = \frac{0}{-3}$$

$$m = 0$$

Find slope:

① $(-2, 5), (3, -6)$
 $x_1, y_1 \quad x_2, y_2$
 $m = \frac{-6-5}{3-(-2)} = \frac{-11}{5}$
 $m = -2\frac{1}{5}$

② $(8, -4), (0, 2)$
 $x_2, y_2 \quad x_1, y_1$
 $m = \frac{-4-2}{8-0} = \frac{-6}{8} = \frac{-3}{4}$
 $m = -\frac{3}{4}$

③ $(6, 7), (6, 9)$
 $x_1, y_1 \quad x_2, y_2$
 $m = \frac{9-7}{6-6} = \frac{2}{0}$ undefined

Pg. 129 # 2, 3

show work for #2

2.a. $(1, 1), (4, 3)$
 $x_1, y_1 \quad x_2, y_2$
 $\frac{3-1}{4-1} = \frac{2}{3}$ $m = \frac{2}{3}$ Take out

$m = \frac{y_2 - y_1}{x_2 - x_1}$

② e. $(5, 3), (7, 3)$
 $x_2, y_2 \quad x_1, y_1$

slope $\frac{3-3}{5-7} = \frac{0}{-2}$ $m = 0$

③ h. $(2, -3), (0, 4)$
 $x_1, y_1 \quad x_2, y_2$

$\frac{4-(-3)}{0-2} = \frac{7}{-2}$ $m = -3.5$

③ g. $(0.5, 3), (2, -3)$
 $x_1, y_1 \quad x_2, y_2$

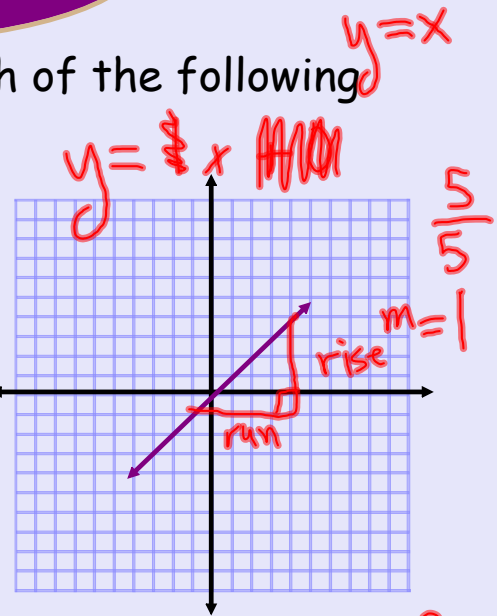
$\frac{-3-3}{2-0.5} = \frac{-6}{1.5} = -4$ $m = -4$

Practice:

State what the slope is for each of the following questions:

1. $y = -2/3x + 2$

2.



3. $(1,4)$ $(-8,-7)$
 $x_1 y_1$ $x_2 y_2$

$$\frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{\Delta y}{\Delta x} = \frac{-7-4}{-8-1} = \frac{-11}{-9}$$

$$m = \frac{11}{9} = 1\frac{2}{9}$$

Pg. 129
 #2,3

Show your work for #2

For example:
 #2a. $(1,1)$ $(4,3)$ \leftarrow
 $x_1 y_1$ $x_2 y_2$

$$m = \frac{3-1}{4-1} = \frac{2}{3} \quad (m = \frac{2}{3})$$

slope (m) $m = \frac{y_2 - y_1}{x_2 - x_1}$

2.f. $(-3,4)$ $(5,-2)$
 $x_1 y_1$ $x_2 y_2$

$$\frac{-2-4}{5-(-3)} = \frac{-6}{8} \quad m = \frac{-6}{8}$$

$$m = -0.75$$

$$\frac{4-(-2)}{-3-5} = \frac{6}{-8} \quad (m = \frac{-6}{8})$$

g. $(-3,-1)$ $(-5,7)$

$$\frac{-1-7}{-3-(-5)} = \frac{-8}{+2} \quad (m = -4)$$

3i. $(2\frac{1}{5}, -3)$ $(-3\frac{1}{2}, \frac{1}{2})$
 $(2.2, -3)$ $(-3.5, 0.5)$
 $x_1 y_1$ $x_2 y_2$

$$\frac{0.5-(-3)}{-3.5-2.2} = \frac{3.5}{-5.7} \quad (m = -0.61)$$

Rearranging Equations
into the form

$$\boxed{y = mx + b}$$

\uparrow slope \uparrow y-int.

Example

$$\begin{aligned}
 2y - 4 &= 7x \\
 2y &= 7x + 4 \\
 \frac{2y}{2} &= \frac{7x + 4}{2}
 \end{aligned}$$

$$\boxed{y = \frac{7}{2}x + 2}$$

1) $\cancel{5x} + 3y = 7$

3) $2y - 3 = 7x$

2) $4x = 3 - 5y$

4) $5 = 3y - 4x$

Rearrange ($y = mx + b$), $m =$, $b =$

$$\begin{aligned}
 1) \quad 3y &= -5x + 7 \\
 \frac{3y}{3} &= \frac{-5x + 7}{3} \\
 y &= -\frac{5}{3}x + \frac{7}{3}
 \end{aligned}$$

$$\begin{aligned}
 2) \quad 3 - 5y &= 4x \\
 -5y &= 4x - 3 \\
 \frac{-5y}{-5} &= \frac{4x - 3}{-5} \\
 y &= -\frac{4}{5}x + \frac{3}{5}
 \end{aligned}$$

$$0 = 2 - 3y + 4x$$

+3y +3y

$$3y = 4x + 2$$

$$y = \frac{4}{3}x + \frac{2}{3}$$

$$y = -x + 1$$

Pg. 129 #1 (e-h), 2 (e-h) *

Pg. 132 #1 ($y = mx + b$)

Pg. 129

#1 e. $m = \frac{3}{6} = \frac{1}{2}$

f. $m = -\frac{1}{2}$

g. $m = 0$

h. $m = \text{undefined}$

#2 e. $(5, 3)$ $(7, 3)$
 x_1, y_1 x_2, y_2

$$m = \frac{3-3}{7-5} = \frac{0}{2}$$

$m = 0$

f. $m = \frac{-2-4}{5-(-3)}$

$$m = \frac{-6}{8} = -\frac{3}{4}$$

g. $m = \frac{-1-7}{-3-5} = \frac{-8}{-8} = 1$

h. $m = \frac{4-(-3)}{0-2} = \frac{7}{-2} = -3\frac{1}{2}$

$= -1$

Pg. 132 #1

$$a) \quad \cancel{5x} + 3y = 7 \quad \cancel{-5x}$$

$$\frac{3}{3}y = \frac{-5x + 7}{3}$$

$$y = -\frac{5}{3}x + \frac{7}{3}$$

$$d) \quad 7x + 2 = -3y$$

$$\frac{3y}{-3} = \frac{7x + 2}{-3}$$

$$y = -\frac{7}{3}x - \frac{2}{3}$$

Pg. 132 #1 Rearranging Equations into the form $y = mx + b$

\uparrow slope
 \uparrow y-int.

$$d) \quad 7x + 2 = -3y$$

$$\frac{-3y}{-3} = \frac{7x + 2}{-3}$$

$$y = -2.\bar{3}x - 0.\bar{6}$$

$$k) \quad 0 = 2 - 3y + 4x$$

$$+3y \quad +3y$$

$$\frac{3y}{3} = \frac{2 + 4x}{3}$$

$$y = \frac{2}{3} + \frac{4}{3}x$$

$$y = \frac{4}{3}x + \frac{2}{3}$$

$$y = mx + b$$

$$y = mx + b$$

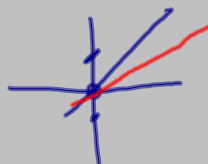
\uparrow \uparrow
 slope y-int.

$$h) \quad 3x - 4y = 0$$

$$\cancel{3x} \quad \cancel{-3x} \quad \uparrow \quad -3x$$

$$\frac{-4y}{-4} = \frac{-3x}{-4}$$

$$y = \frac{3}{4}x + 0$$



Pg. 117 - Focus G

→ you will learn how an equation ($y=mx+b$) relates to a graph

Slope - means "rate"
 - growth rate
 - speed
 - \$/hr

Example:
 - speed
 (m/s)
 (km/hr)

y-int. = 20

$$y = mx + b$$

$$y = mx + \underline{20}$$

slope? $m = \frac{y_2 - y_1}{x_2 - x_1}$

(0, 20)

(10, 40)

$$m = \frac{40 - 20}{10 - 0}$$

$$m = \frac{20}{10}$$

$$m = 2$$

$$y = 2x + 20$$

base fee = 20

hourly rate = \$2/hr.

Pg

Connecting Equations & Graphs of Lines:

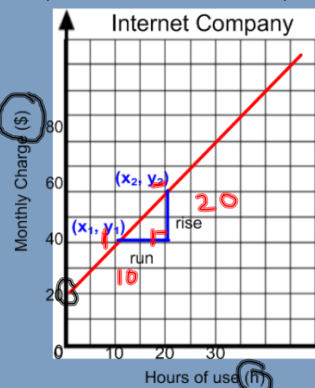
Focus G: Page 117

Suppose you were only given a graph representing an Internet company and you had to decide if this company was going to work for you. What information could you gain?

- To find the **hourly rate** (charge/hour), we would find the **slope (m)**:

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

- To find the **initial (base) rate**, find the **y-intercept (b)**



- Calculate slope (units!)

$$(10, 40) \text{ and } (20, 60)$$

$$x_1, y_1 \text{ and } x_2, y_2$$

$$m = \frac{60 - 40}{20 - 10} = \frac{20}{10}$$

$$m = \$2/\text{hr.}$$

- y-intercept = 20 (flat fee)

- Write the eqn. of the line ($y=mx+b$)

$$y = 2x + 20$$

Pg. 117

- y-int. is 20

- slope (m) $m = \frac{y_2 - y_1}{x_2 - x_1}$ $\begin{matrix} (10, 40) \\ (20, 60) \end{matrix}$

$$= \frac{60 - 40}{20 - 10} = \frac{20}{10} = 2$$

$m = 2$

- Eqn. of the line: $y = mx + b$

5 hours of use: $y = 2x + 20$

$y = 2(5) + 20$

$y = 10 + 20$ \$2/hr 20 fee

$y = 30$

It costs \$30 for 5 hrs. of use.

$y = \overset{\downarrow}{m}x + \overset{\downarrow}{b}$ $m = \frac{y_2 - y_1}{x_2 - x_1}$

"rate" means slope

"basic fee" means y-int.

Investigation 5 Pg. 118-119

Answer A, B, C

#1-4

(A) $y = mx + b$ $m = \text{slope}$
 $b = \text{y-int.}$

Company 1 (12, 45) (0, 10)

$m = \frac{y_2 - y_1}{x_2 - x_1}$ $m = \frac{45 - 10}{12 - 0} = \frac{35}{12}$ $m = 2.9$

$y = 2.9x + 10$

(B) Company 2 (0, 20) (10, 35)

$m = \frac{35 - 20}{10 - 0} = \frac{15}{10}$ $m = 1.5$

$y = 1.5x + 20$

(C) Company 3 (2, 20) (8, 35)

$m = \frac{35 - 20}{8 - 2} = \frac{15}{6}$ $m = 2.5$

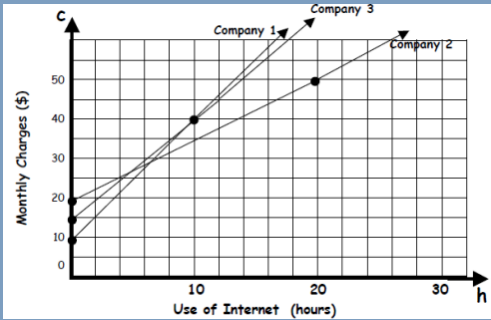
$y = 2.5x + 15$

Domain $\{x \mid x \geq 0, x \in \mathbb{R}\}$

Range $\{y \mid y \geq 15, y \in \mathbb{R}\}$

Investigation #5 - Page 119

The rates for 3 Internet companies are shown on the graph below:



Fill in the chart below to write an equation for the monthly rate for each Internet company:

	y-intercept (c-intercept)	slope	Equation in (Standard Form)	Equation of Graph
Company 1				
Company 2				
Company 3				

Company 1: $c = 3h + 10$
 Company 2: $c = 20 + 1.5h$
 Company 3: $c = 15 + 2.5h$

1. Suppose you have \$50.00 per month to spend. Which company would you go with?

2. You can read any two points on a graph to find out the hourly cost for a length of time. Find the average hourly cost of Company 2.

$$\begin{array}{r} \#1 \\ 50 = 2.9x + 10 \\ -10 \quad -10 \\ \hline 40 = 2.9x \\ \frac{40}{2.9} = \frac{2.9x}{2.9} \quad x = 13.8 \\ C\#1 \rightarrow \underline{13.8 \text{ hrs}} \end{array}$$

$$\begin{array}{r} 50 = 1.5x + 20 \\ -20 \quad -20 \\ \hline 30 = 1.5x \\ \frac{30}{1.5} = \frac{1.5x}{1.5} \quad x = 20 \\ C\#2 \rightarrow \underline{20 \text{ hrs}} \end{array}$$

$$\begin{array}{r} 50 = 2.5x + 15 \\ -15 \quad -15 \\ \hline 35 = 2.5x \\ \frac{35}{2.5} = \frac{2.5x}{2.5} \quad x = 14 \text{ hrs} \end{array}$$

I would use Company 2
because you can get the
greatest number of hours.
20 hrs.

Pg. 118
Eqn. for C. 1, 2, 3

$$y = mx + b$$

↑ ↑

© Company 3
Find slope

(6, 30) (2, 20)

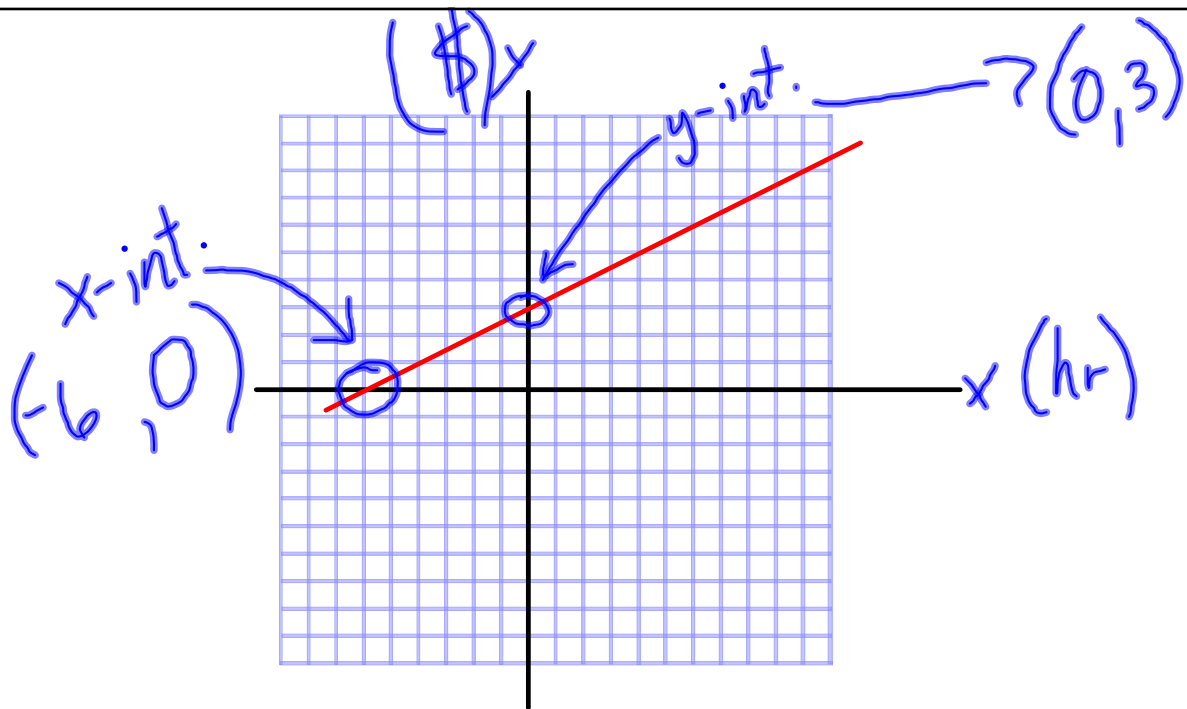
$$\frac{\$}{\text{hr}} \quad \frac{30 - 20}{6 - 2} = \frac{10}{4} = 2.5$$

\$2.50/hr.

C. $y = 2.5x + 18$

↑ ↑

\$/hr flat fee



Helpful Hints for Investigation 5 (Pg.119)

- #2. the c-intercept = y-intercept
 the h-intercept = x-intercept
 (just using different labels)
- Look at each graph and estimate values
 - what does each value mean?
 - you don't need help with this one!

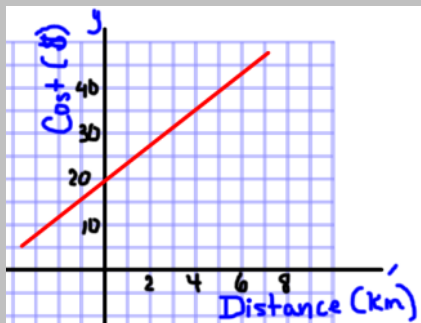
#3 (you did the same thing that it is asking when you found slope)

#4 Just explain what someone would have to do to find out hourly cost and base fare from a graph.....

Warm-up #16

1. Calculate the slope of a line that passes through the points (5, 9) and (8, 2). (SHOW YOUR WORK)

2. Find the slope and y-intercept from the graph:



3. Write the equation of the line from #2.

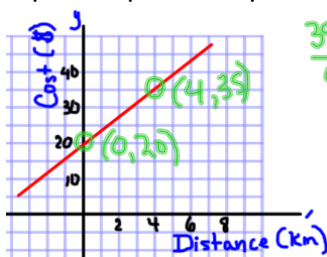
4. What does the slope represent in this situation (in #2) and what is the base fee?

Warm-up #16

1. Calculate the slope of a line that passes through the points (5, 9) and (8, 2). (SHOW YOUR WORK)

$$m = \frac{9-2}{5-8} = \frac{7}{-3} = -\frac{7}{3} \quad \checkmark$$

2. Find the slope and y-intercept from the graph:



$$\frac{30-20}{4-0} = \frac{10}{4} = 2.5 \quad \checkmark$$

$$y\text{-int} = 20 \quad \checkmark$$

3. Write the equation of the line from #2.

$$y = 2.5x + 20$$

4. What does the slope represent in this situation (in #2) and what is the base fee?

\checkmark
 \checkmark
 \checkmark
 = 20
 \checkmark
 Cost/distance
 \$/km
 \checkmark

Example: To deliver soil, Tip Top Soil has a fixed charge plus a charge per "yard" of soil as shown in the graph:

a) Write an equation for the cost to deliver soil.

Use the slope y-intercept form:

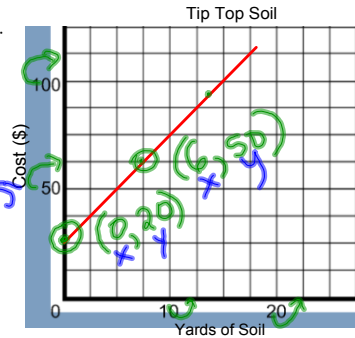
$$(y = mx + b)$$

Remember you will need:

- Slope (m) (cost/yard)
- y-intercept (b)

$$m = \frac{20 - 50}{0 - 6} = \frac{30}{-6} = -5$$

$$b = 20$$



b) How many yards of soil can you purchase for \$125.00?

$$y = 5x + 20$$

$$125 = 5x + 20$$

$$-20 \quad -20$$

$$\frac{105}{5} = \frac{5x}{5} \quad x = 21$$

Classwork/Homework

Pg. 119-121 # 5-12

Attachments

Sec 3.4 - Slopes.doc

Sec 3.4 - Write the equation of a line (1).doc

3.4 Review Assignment.doc

sec. 3.4 - Write the equation of a line (2).doc